SSNP111 - Transition of Gauss points with the nodes on quadratic elements

Summarized:

It is about a test of static mechanics nonlinear.

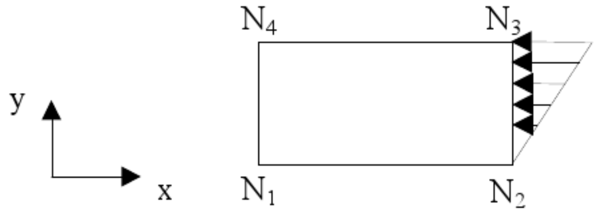
The goal is to test, in the order `CALC_CHAMP`, the matrixes making it possible to place from the points of integration to the nodes tops. The treated case relates to a plane plate subjected on one of its sides to a pressure varying linearly.

1 Problem of reference

1.1 Geometry

Plates rectangular plane.

$N_1 N_2 = 40\, mm$
$N_1 N_4 = 30\, mm$



1.2 Properties of the materials

the elastic properties of the material are the following ones:

- $E = 200\,000\, MPa$
- $\nu = 0$

The properties material defining a plastic material in linear hardening are the following ones:

- Slope of curve of tension $C = 1930\, Mpa$
- mechanical $\sigma^y = 181\, Mpa$

1.3 Elastic limit Boundary conditions and loadings

Face $N_1 N_2$: blocked according to ox

The node is outside the field of definition with a right profile of the EXCLU type node: N_1 blocked according to oy

The node is outside the field of definition with a right profile of the EXCLU type node: N_2 blocked according to oy

Pressure varying linearly:

$P_{res}(N2) = 0$
$P_{res}(N3) = 300\, MPa$

2 Reference solution

2.1 Method of calculating used for the reference solution

the cumulated plastic strain P is equal to:

$$P=\frac{\sigma_L-\sigma^y}{C}$$

with: σ_L : stress with the node considered
σ^y : elastic limit
C : slope of curve of tension

the stresses are given by:

$$\sigma_{xx}(N_i)=-P_{res}(N_i)$$

The plastic strain is given by:

$$|\varepsilon_{xx}^p(N_i)=P(N_i)|$$

2.2 Results of reference

One calculates with the nodes N_2 and N_3 the uniaxial stress, the plastic strain, as well as the cumulated plastic strain.
Maybe for the problem considered:

	N_2	N_3
σ_{xx}	0	– 300
ε_{xx}	0	– 6.1658 10-2
ε_{xx}^p	0	6.1658 10-2

2.3 Uncertainty on the analytical

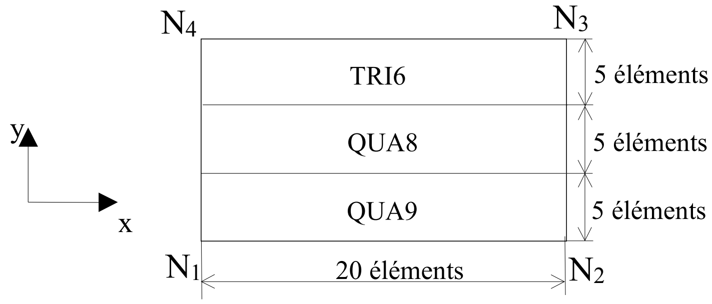
solution Solution.

2.4 Bibliographical references

[1] LORENTZ E., PROIX J.M., VAUTIER I., VOLDOIRE F., WAECKEL F.: Initiation with the thermo - plasticity in the code Aster. Handbook of Reference of the course. EDF-DER, SCE IMA, Dept. Mechanics and digital Models, HI-74/96/013/0

3 Modelization A

3.1 Characteristic of the modelization



3.2 Characteristics of the mesh

Many nodes: 1072
Number of meshes and types: 100 `QUAD9`
100 `QUAD8`
200 `TRIA6`

3.3 Quantities tested and Standard

Identification	results of reference	Value
cumulated Plastic strain Node N_2 at the sequence number 10	"AUTRE_ASTER"	0.0
Plastic strain cumulated Node N_3 at the sequence number 10	"AUTRE_ASTER"	6.16E-2
Plastic strain Node N_2 at the sequence number 10	"AUTRE_ASTER"	0.0
Plastic strain Node N_3 at the sequence number 10	"AUTRE_ASTER"	-6.16E-2
Forced to the Node N_2 at the sequence number 10	"AUTRE_ASTER"	0.0
Stresses with the Node N_3 at the sequence number 10	"AUTRE_ASTER"	-300.0

One calculate the indicators of discharge and loss of radiality in the mesh M_1 :

- at first Gauss point (`DERA_ELGA`),
- node N_{601} (`DERA_ELNO`).

Standard	identification of reference	Value
Discharges at the first Gauss point of the mesh M_1 at the sequence number 7	"NON_REGRESSION"	8.67857E-1
Discharges with the node N_{601} of the mesh M_1 at the sequence number 7	"NON_REGRESSION"	8.91978E-1
Loss from radiality at the first Gauss point of the mesh M_1 at the sequence number 7	"NON_REGRESSION"	3.39734E-3

4 Summary of the results

the results coincide with the reference solution. They thus make it possible to rule on the validity of the transition matrixes of the points of gauss to the nodes tops.